

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
Before the Board of Patent Appeals and Interferences

In re Patent Application of

Atty Dkt. LCM-608-440

C# M#

Confirmation No. 2285

TC/A.U.: 1797

Examiner: Singh, P.C.

Date: March 19, 2008

BURNETT et al

Serial No. 10/509,832

Filed: October 3, 2005

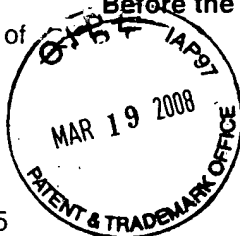
Title: REMOVAL OF NITROGEN, SULFUR, AND ALKYLATING AGENTS FROM
HYDROCARBON STREAMS (AS AMENDED)

Mail Stop Appeal Brief - Patents

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450



AF
\$
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Sir:

☐ **Correspondence Address Indication Form Attached.**

☐ **NOTICE OF APPEAL**

Applicant hereby **appeals** to the Board of Patent Appeals and Interferences
from the last decision of the Examiner twice/finally rejecting
applicant's claim(s).

\$510.00 (1401)/\$255.00 (2401) \$ 0.00

☒ An appeal **BRIEF** is attached in the pending appeal of the
above-identified application

\$510.00 (1402)/\$255.00 (2402) \$ 510.00

☐ Credit for fees paid in prior appeal without decision on merits

-\$ ()

☐ A reply brief is attached.

(no fee)

☒ Petition is hereby made to extend the current due date so as to cover the filing date of this
paper and attachment(s)

One Month Extension \$120.00 (1251)/\$60.00 (2251)
Two Month Extensions \$460.00 (1252)/\$230.00 (2252)
Three Month Extensions \$1050.00 (1253)/\$525.00 (2253)
Four Month Extensions \$1640.00 (1254)/\$820.00 (2254) \$ 120.00

☐ "Small entity" statement attached.

Less month extension previously paid on

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TOTAL FEE ENCLOSED \$ 630.00

☒ **CREDIT CARD PAYMENT FORM ATTACHED.**

Any future submission requiring an extension of time is hereby stated to include a petition for such time extension.
The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or
asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this
firm) to our **Account No. 14-1140**. A duplicate copy of this sheet is attached.

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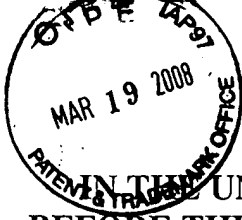
NIXON & VANDERHYE P.C.
By Atty: Leonard C. Mitchard, Reg. No. 29,009

Signature: _____

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For: REMOVAL OF NITROGEN, SULFUR, AND ALKYLATING
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* * * * *

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APPEAL BRIEF

Sir:

Appellant hereby **appeals** to the Board of Patent Appeals and Interferences from
the last decision of the Examiner.

03/20/2008 AWONDAF1 00000063 10509832

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(I) **REAL PARTY IN INTEREST**

The real party in interest is BP Corporation North America, Inc., a corporation of the United States of America.

(II) **RELATED APPEALS AND INTERFERENCES**

The appellant, the undersigned, and the assignee are not aware of any related appeals, interferences, or judicial proceedings (past or present), which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

(III) STATUS OF CLAIMS

Claims 15-31 are pending and are rejected. Claims 1-14 have been canceled. No claims have been substantively allowed. Claims 15-31 are appealed.

(IV) STATUS OF AMENDMENTS

No amendments have been filed since the date of the Final Rejection.

(V) SUMMARY OF CLAIMED SUBJECT MATTER

The invention of independent claim 15 is a process for increasing the boiling point of organic nitrogen species present within a liquid hydrocarbon feed (page 1, lines 10-11). The process comprises contacting a liquid hydrocarbon feed comprising an alkylating agent and organic nitrogen species (page 1, lines 12-13 and 20), the liquid hydrocarbon feed being one or more petroleum fractions with a boiling range of 10-450°C (page 4, line 29) selected from catalytically cracked naphtha, coker naphtha and visbroken naphtha (page 4, lines 31-32), with an acidic catalyst at elevated temperature in a first reaction zone to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content and organic nitrogen species of higher boiling point (page 2, lines 1-4). The invention of independent claim 16 is a process for reducing the nitrogen content of a liquid hydrocarbon feed (page 2, lines 5-6 and 25-26). The process comprises (a) contacting a liquid hydrocarbon feed comprising an alkylating agent and organic nitrogen species (page 2, lines 28-29), the liquid hydrocarbon feed being one or more petroleum fractions with a boiling range of 10-450°C (page 4, line 29) selected from catalytically cracked naphtha, coker naphtha and visbroken naphtha (page 4, lines 31-32), with an acidic catalyst at elevated temperature in a first reaction zone to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content and organic nitrogen species of higher boiling point (page 2, lines 29-31); and (b) removing the organic nitrogen species of higher boiling point to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content and a reduced nitrogen content (page 2, lines 19-21).

(VI) GROUND OF REJECTION TO BE REVIEWED ON APPEAL

The sole ground of rejection to be reviewed on appeal is the obviousness rejection of claims 15-31 over U.S. Patent 6,048,451 to Huff, Jr., et al. (Huff).

(VII) ARGUMENT

Claims 15-31 stand rejected under 35 U.S.C. §103(a) as allegedly unpatentable over U.S. Patent 6,048,451 to Huff, Jr., et al. (Huff). Reversal of that rejection is respectfully requested.

The process as claimed in claim 15 is for increasing the boiling point of organic nitrogen species present within a liquid hydrocarbon feed. The process comprises contacting a liquid hydrocarbon feed comprising an alkylating agent and organic nitrogen species, the liquid hydrocarbon feed being one or more petroleum fractions with a boiling range of 10-450°C selected from catalytically cracked naphtha, coker naphtha and visbroken naphtha, with an acidic catalyst at elevated temperature in a first reaction zone to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content and organic nitrogen species of higher boiling point.

Claim 16 claims a process for removing organic nitrogen compounds from a hydrocarbon feedstock in which, as a first step, a hydrocarbon feedstock comprising an alkylating agent and organic nitrogen compounds is contacted with an acid catalyst at elevated temperature to produce organic nitrogen compounds of higher boiling point.

Prior to the present invention, the approach in the art was to remove nitrogen compounds from hydrocarbon streams before contacting the streams with an acid catalyst to remove organic sulfur compounds. Thus, the skilled artisan would have been motivated to protect an acid catalyst by prior removal of basic nitrogen-containing compounds. This is also consistent with Huff which discloses that nitrogen-containing compounds must be removed from the hydrocarbon stream prior to contact of the stream with the acidic catalyst used for reacting organic sulfur compounds.

Huff discloses that to achieve nitrogen removal, one can use conventional acid wash or guard-bed technology. For removal of basic nitrogen compounds, Huff discloses that an acidic material should be used, as it will be expected to entrap/absorb the basic nitrogen compounds. Once the absorbent is "full" or "spent", it is regenerated and reused. Often, a dual absorbent bed is used, such that one absorbs while the other is regenerated in order to provide continuity (see Huff at column 10, lines 55 to 62).

In contrast, according to the present invention, it has been found that acidic compounds can act catalytically and facilitate reaction of the nitrogen-containing compounds to produce organic nitrogen compounds of higher boiling point. For example, it has been discovered by the present inventors that under the conditions of acidic catalysis, organic nitrogen species can condense with each other, they can react with aromatic species, or they can react with an alkylating agent. The result is the formation of organic nitrogen species of higher boiling point (see, for example, page 1 lines 15-18 of the application). The present inventors realized that this could be used to advantage, in that the higher-boiling nitrogen compounds so-produced remain in the hydrocarbon stream, where they can then be readily separated by techniques such as distillation.

In the Advisory Action mailed November 15, 2007, it is stated on page 2: "Thus, nitrogen removal in the Huff process is similar to Applicant's claim". In response, the processes are not "similar", since Huff teaches nitrogen **removal** from the liquid hydrocarbon stream **prior** to contact of the liquid hydrocarbon with the acid catalyst whereas, in the presently claimed process, there is **no removal** of nitrogen prior to contact with the acid catalyst. Instead, as is clear from the claim language, nitrogen is

present in the liquid hydrocarbon feed that is contacted with the acid catalyst. Thus, there is **no** similarity in “nitrogen removal” in the two processes.

On page 2 of the Advisory Action, it is further stated: “So the mechanism of nitrogen removal should be the same in both cases”. In response, the mechanism of nitrogen removal is irrelevant to the issue of obviousness in view of Huff. The question is whether Huff renders obvious the presently claimed step of contacting the liquid hydrocarbon feed containing organic nitrogen species with the acid catalyst. Huff does not render that step obvious because Huff leads the person of ordinary skill to **remove** nitrogen species **prior** to contacting with the acid catalyst.

On page 2 of the Advisory Action, it is also stated: “As discussed earlier, nitrogen is being removed by using a solid catalyst similar to the solid catalyst used to remove sulfur downstream”, and “Huff process must also be converting the nitrogen compounds to other nitrogen compounds of higher boiling point...”. Again, the fundamental question is whether it would have been obvious in view of Huff to contact a liquid hydrocarbon feed containing organic nitrogen species with an acid catalyst. Huff does **not** render that step obvious because Huff leads the skilled artisan to remove nitrogen species **prior** to contacting with the acid catalyst.

Huff does not suggest the claimed step of contacting “a hydrocarbon feedstock comprising an alkylating agent and organic nitrogen compounds” at elevated temperature with an acid catalyst “to produce organic nitrogen compounds of higher boiling point”. Huff discloses that organic nitrogen compounds can cause catalyst deactivation and, hence, are **removed prior** to contact with the acidic catalyst in order to prevent damage to the acid catalyst (see, column 10, lines 54-67). This removal of organic nitrogen

compounds is stated to be achieved by conventional means, such as by using an acid wash or a guard bed positioned in front of the acid catalyst. There is no suggestion in Huff of producing organic compounds of higher boiling point. This is in marked contrast to the presently claimed process, wherein the liquid hydrocarbon stream to be contacted with the acidic catalyst comprises "organic nitrogen species". The liquid hydrocarbon stream to be contacted by the acid catalyst in Huff does **not** contain organic nitrogen species, and there is **no** suggestion to one of ordinary skill to modify Huff in such a way that the Huff liquid hydrocarbon stream which contacts the acid catalyst does contain organic nitrogen species.

In the present process, by contacting a hydrocarbon feedstock comprising alkylating agent with an acid catalyst at elevated temperature, organic nitrogen species within the hydrocarbon feedstock are converted to organic nitrogen species of increased boiling point. This is **not** suggested by Huff and, indeed, Huff leads away from this approach by disclosing that, since nitrogen-containing organic compounds can react with the acidic catalyst and deactivate it (column 10, lines 48-51), the nitrogen-containing compounds are removed **beforehand** by another means such as by using an acid wash or a guard bed positioned in front of the acid catalyst.

Thus, one of ordinary skill in the art, based on Huff, would **not** have been motivated to contact nitrogen-containing organic compounds with an acidic catalyst in view of the risk of catalyst deactivation. In light of this, in Huff, organic nitrogen is removed via the acid wash/guard bed treatment **before** contact with the acidic catalyst. In particular, Huff discloses at column 10, lines 54-59 that organic nitrogen species are removed from the feedstock before being contacted with the acid catalyst by using

conventional guard bed or acid wash technology. Guard beds and acid wash units are well known to those skilled in the art and operate by absorption, not by catalysis. This is evidenced by Huff at column 10, lines at 59-65, where regeneration of the guard bed or acid wash is discussed.

The Office asserts that it would have been obvious to modify Huff to remove nitrogen compounds also by fractionation “because any suitable separation technique will be equally effective.” This is not correct, because contacting nitrogen-containing compounds with the acidic catalyst runs the risk of deactivation of the catalyst which would **not** be seen by one of ordinary skill as “equally effective”. The suggestion by the Office to so modify Huff is clearly based on hindsight in light of the discovery of the present invention, which is not proper basis for rejection.

In summary, Huff leads away from the concept of increasing the boiling point of organic nitrogen species by contact with an acidic catalyst because of problems with catalyst deactivation and, instead, points to removal of nitrogen-containing compounds using guard beds and acid wash units prior to contact with the acidic catalyst. Based on Huff, the person of ordinary skill would understand that the guard bed/acid wash treatment serves to remove organic nitrogen compounds, and does not convert them to other organic nitrogen compounds of higher boiling point.

In light of the above, one of ordinary skill in this art would not have been motivated to arrive at the presently claimed invention based on the Huff disclosure, as there would have been no motivation to contact a liquid hydrocarbon stream comprising organic nitrogen with an acidic catalyst due to the problem of catalyst deactivation. Absent any such motivation, it is clear that a *prima facie* case of obviousness has not

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been generated in this case. Reversal of the outstanding obviousness rejection is accordingly respectfully requested.

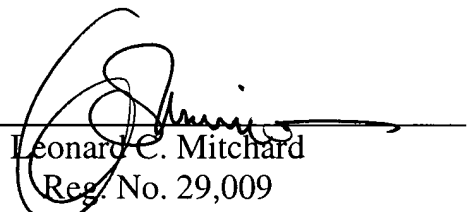
CONCLUSION

In conclusion it is believed that the application is in clear condition for allowance. Early reversal of the Final Rejection and passage of the subject application to issue are earnestly solicited.

Respectfully submitted,

NIXON & VANDERHYE P.C.

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(VIII) CLAIMS APPENDIX

15. A process for increasing the boiling point of organic nitrogen species present within a liquid hydrocarbon feed wherein said process comprises contacting a liquid hydrocarbon feed comprising an alkylating agent and organic nitrogen species, said liquid hydrocarbon feed being one or more petroleum fractions with a boiling range of 10-450°C selected from the group consisting of catalytically cracked naphtha, coker naphtha and visbroken naphtha, with an acidic catalyst at elevated temperature in a first reaction zone to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content and organic nitrogen species of higher boiling point.

16. A process for reducing the nitrogen content of a liquid hydrocarbon feed wherein said process comprises:

a) contacting a liquid hydrocarbon feed comprising an alkylating agent and organic nitrogen species, said liquid hydrocarbon feed being one or more petroleum fractions with a boiling range of 10-450°C selected from the group consisting of catalytically cracked naphtha, coker naphtha and visbroken naphtha, with an acidic catalyst at elevated temperature in a first reaction zone to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content and organic nitrogen species of higher boiling point; and

b) removing the organic nitrogen species of higher boiling point to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content and a reduced nitrogen content.

17 (previously presented). A process according to claim 16 wherein the organic nitrogen species of higher boiling point is removed by fractionation.

18 (previously presented). A process according to claim 16 for reducing the sulphur and nitrogen content of a liquid hydrocarbon feed wherein said process comprises:

- a) contacting a liquid hydrocarbon feed comprising an alkylating agent and organic nitrogen and organic sulphur species, said liquid hydrocarbon feed being one or more petroleum fractions with a boiling range of 10-450°C selected from the group consisting of catalytically cracked naphtha, coker naphtha and visbroken naphtha, with an acidic catalyst at elevated temperature in a first reaction zone to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species and organic nitrogen species of higher boiling point;
- b) contacting the liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species and organic nitrogen species of higher boiling point with an acidic catalyst at elevated temperature in a second reaction zone to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species of higher boiling point and organic nitrogen species of higher boiling point; and
- c) fractionating the liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species of higher boiling point and organic nitrogen species of higher boiling point to remove the organic nitrogen species of higher boiling point and the organic sulphur species of higher boiling point to generate a liquid

hydrocarbon feed comprising a reduced alkylating agent content and a reduced nitrogen and sulphur content.

19 (previously presented). A process according to claim 16 for reducing the sulphur and nitrogen content of a liquid hydrocarbon feed wherein said process comprises:

a) contacting a liquid hydrocarbon feed comprising an alkylating agent and organic nitrogen and sulphur species, said liquid hydrocarbon feed being one or more petroleum fractions with a boiling range of 10-450°C selected from the group consisting of catalytically cracked naphtha, coker naphtha and visbroken naphtha, with an acidic catalyst at elevated temperature in a first reaction zone to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species and organic nitrogen species of higher boiling point;

b) fractionating the liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species and organic nitrogen species of higher boiling point to remove the organic nitrogen species of higher boiling point to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species and a reduced nitrogen content;

c) contacting the liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species and a reduced nitrogen content with an acidic catalyst at elevated temperature in a second reaction zone to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species of higher boiling point and reduced nitrogen content; and

d) fractionating the liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species of higher boiling point and a reduced nitrogen content to remove the organic sulphur species of higher boiling point to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content and a reduced nitrogen and sulphur content.

20 (previously presented). A process according to claim 16 wherein the liquid hydrocarbon feed is selected from the group consisting of diesel, gasoline, kerosene and jet fuel.

21 (previously presented). A process according to claim 16 wherein organic nitrogen species is selected from the group consisting of alkyl amines, anilines, pyroles and pyridines.

22 (previously presented). A process according to claim 16 wherein the liquid hydrocarbon feed comprising organic nitrogen species usually has a total nitrogen content (expressed as elemental N) of between 5-3000ppm N.

23 (previously presented). A process according to claim 16 wherein the organic nitrogen species have a boiling point of between 50 and 450°C.

24 (previously presented). A process according to claim 18 wherein the organic sulphur species is selected from the group consisting of mercaptans, thiophenes, benzothiophene, dibenzothiophenes and hindered alkyl substituted dibenzothiophenes.

25 (previously presented). A process according to claim 18 wherein the liquid hydrocarbon feed comprising an alkylating agent and organic nitrogen and sulphur species has a total sulphur content (expressed as elemental S) of 10-50000ppm S.

26 (previously presented). A process according to claim 19 wherein the organic sulphur species is selected from the group consisting of mercaptans, thiophenes, benzothiophene, dibenzothiophenes and hindered alkyl substituted dibenzothiophenes.

27 (previously presented). A process according to claim 19 wherein the liquid hydrocarbon feed comprising an alkylating agent and organic nitrogen and sulphur species has a total sulphur content (expressed as elemental S) of 10-50000ppm S.

28 (previously presented). A process according to claim 16 wherein the acidic catalyst is a solid.

29 (previously presented). A process according to claim 16 wherein the first reaction zone is maintained at a temperature of between 50°C-300°C and at pressure of between 1-100 bar.

30 (previously presented). A process according to claim 18 wherein the second reaction zone is maintained at a temperature of between 100°C-300°C and at pressure of between 1-100 bar.

31 (previously presented). A process according to claim 19 wherein the second reaction zone is maintained at a temperature of between 100°C-300°C and at pressure of between 1-100 bar.

(IX) EVIDENCE APPENDIX

None.

(X) **RELATED PROCEEDINGS APPENDIX**

None.